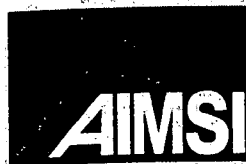


RSALOP

Radionuclide Soil Action Levels Oversight Panel

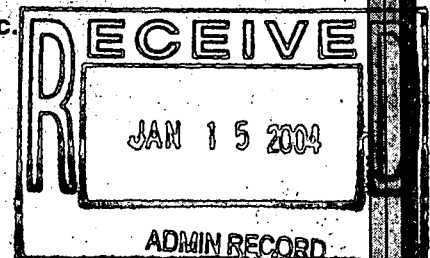
Public Meetings

Compiled by:



Advanced Integrated Management Services, Inc.
5460 Ward Road, Suite 370
Arvada, CO 80002
(303) 456-0884 fax. (303) 456-0858

1998/1999



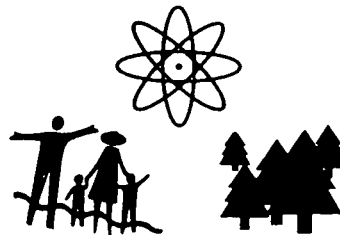
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March 10, 1999

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Radionuclide Soil Action Level Oversight Panel



AGENDA

Public Meeting - March 10, 1999 - 6:30 - 9:00 P.M.
Westminster City Hall - City Council Chambers

6:30 - 7:00	Project Open House - Foyer	
7:00 - 7:10	Welcome/Agenda Review	Laura Till, Facilitator
7:10 - 7:30	Project Introduction/Background	Mary Harlow, Co-Chair Hank Stovall, Co-Chair
7:30 - 8:30	Project Overview <ul style="list-style-type: none">• Task 1 - Cleanup Levels at Other Sites• Task 2 - Computer Models• Task 3 - Inputs & Assumptions• Task 4 - Methodology• Task 5 - Independent Calculation• Task 6 - Sampling Protocols Status Report on Work to Date <ul style="list-style-type: none">• Computer Modeling• Project Scenarios	Risk Assessment Corporation (RAC): Dr. John Till, President Arthur S. Rood Dr. Helen Grogan
8:30 - 8:45	Public Comments/Questions	Facilitator
8:45 - 9:00	Public Participation Opportunities <ul style="list-style-type: none">- Monthly Meetings- Community Briefings- Public Meetings Wrap-Up/Thank you	Co-Chairs Co-Chairs

UPCOMING MEETINGS/ACTIVITIES

March 11	RSALOP Monthly Meeting	4-7 P.M. Broomfield City Building*
April 8	RSALOP Monthly Meeting	4-7 P.M. Broomfield City Building*
May 13	RSALOP Monthly Meeting	4-7 P.M. Broomfield City Building*
June 10	RSALOP Monthly Meeting	4-7 P.M. Broomfield City Building*
July 8	RSALOP Monthly Meeting	4-7 P.M. Broomfield City Building*
August 12	RSALOP Monthly Meeting	4-7 P.M. Broomfield City Building*
September 9	RSALOP Monthly Meeting	4-7 P.M. Broomfield City Building*
October 14	RSALOP Monthly Meeting	4-7 P.M. Broomfield City Building*
November 11	RSALOP Monthly Meeting	4-7 P.M. Broomfield City Building*

**IMPORTANT NOTE: TECHNICAL DISCUSSIONS ARE SCHEDULED FROM 2:30 - 3:30 IN THE BAL SWAN
CONFERENCE ROOM - ADJACENT TO ZANG'S SPUR - PRIOR TO ALL MEETINGS**

*Broomfield City Building, One Descombes Dr. - Zang's Spur/Bal Swan Conference Rooms (lower level)

RADIONUCLIDE SOIL ACTIVITY LEVEL OVERSIGHT PANEL
PUBLIC MEETING ATTENDEES
MARCH 10, 1999

NAME	ORGANIZATION	ADD TO MAILING LIST	MAILING ADDRESS
Barb McTurk	Senator Wayne Allard		[REDACTED]
Greg Murray			
TODD MARGULES	RSALOP		
Brady Wilson	CAB Scott		
Roman Kohler	Citizen	✓	
Patrick Etchart	DOE RFFO		
KEV STARR	JEFFO HEALTH + ENV		
VICTOR HOLM	RFCAB		
Doug Young	Congressman Mark Udall	✓	
LeRoy Moore	Rocky Mtn Peace + Justice		
Rick DiSalvo	RFFO		
JOEL SELBON	RSALOP		
Dave Shelton	Kaiser Hill		

80403

RADIOISOTOPE SOIL ACTIVITY LEVEL OVERSIGHT PANEL
PUBLIC MEETING ATTENDEES
MARCH 10, 1999

NAME	ORGANIZATION	ADD TO MAILING LIST	MAILING ADDRESS
Matt Archer	BSA		
Susan Archer			
Carl Spreng	CDPHE		
Niels Schonbeck	Metro State Col.		
Mark Husted	BSA		
V. Kohler	BSA		
Jeany Kohler	BSA		
John Krighbaum	BSA		
Sean McMurtry	BSA		
Jared Orstfeld	BSA		
Jared Orstfeld	City of Fed.		
Ken Marshall	DHPTC		
Howard C Bachman			

RADIOISOTOPE SOIL ACTIVITY LEVEL OVERSIGHT PANEL
PUBLIC MEETING ATTENDEES
MARCH 10, 1999

3 of 3

NAME	ORGANIZATION	ADD TO MAILING LIST	MAILING ADDRESS
Russell McCall	HPR DOERFFER		
Helen Grogan	RAC		
Len Ackland	CU	✓	
Anna Corbett	AMS1		
Carla Sande	AMS1		
Hank Stovall	RSACOP		
Mary Harlow	RSALOP		
John Till	RAC		
Laura Till	Facilitator		
Helen Grogan	RAC		
Arthur Rood	RAC		
Ren Kortia	RFCAS		

**ADVANCED INTEGRATED
MANAGEMENT SERVICES, INC.**



FACSIMILE TRANSMITTAL SHEET

TO: <u>Russell McCallister</u>	FROM: <u>Anna Corbett</u>
COMPANY:	DATE: <u>3/11/99</u>
FAX NUMBER: <u>303-966-3710</u>	TOTAL NO. OF PAGES INCLUDING COVER: <u>4</u>
SENDER'S PHONE NUMBER: <u>[REDACTED]</u>	SENDER'S FAX NUMBER: <u>[REDACTED]</u>
RE: <u>RSALOP Public Meeting Attendance Roster</u>	

☐ URGENT ☒ FOR REVIEW ☐ PLEASE COMMENT ☐ PLEASE REPLY ☐ PLEASE SIGN

NOTES/COMMENTS:

6

NEWS RELEASE

For Immediate Release

Contact: Carla Sanda, AIMS
(303) 277-0753

HOW MUCH IS "*TOO MUCH*" PLUTONIUM IN ROCKY FLATS SOILS?

WESTMINSTER, Colo., March 5, 1999 --National attention is focusing on a study currently underway regarding soil cleanup levels for Rocky Flats, the former nuclear weapons production plant located in Jefferson County. A public meeting is scheduled from 6:30 - 9:00 p.m. on Wednesday, March 10 at the Westminster City Hall, 4800 W. 92nd Ave., Westminster, CO. The evening will begin with a 30-minute open house designed to provide background information, followed by briefings regarding the progress to date and future goals for the study.

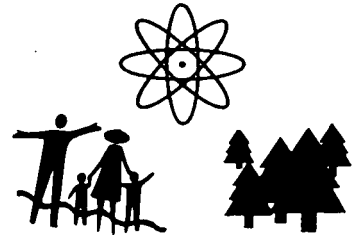
As Rocky Flats moves closer to final remediation goals, one of the primary challenges facing site officials and residents is determination of the amount of radionuclides, such as plutonium, that may legally remain in the soil following remediation. These levels are known as "radionuclide soil action levels" because remediation is triggered when the amount of radioactive material in the soil exceeds established levels. A cleanup agreement negotiated in 1996 between site officials and its regulators set interim levels for plutonium and other contaminants that could remain in the soil at the site. Some members of the community, however, believed that those interim levels were too high. As a result, the Department of Energy agreed to fund a citizen-directed, independent review of the calculation of the soil action levels. To provide oversight of the study, the Radionuclide Soil Action Levels Oversight Panel (Panel) - comprised of scientists, local government representatives and citizens - was formed in 1998. After a formal bidding process, the Panel selected *Risk Assessment Corporation (RAC)* to conduct the technical review. Work has been proceeding since last fall and is scheduled for completion in November 1999.

This public meeting is the first of three to be scheduled throughout the course of the project. Briefings will explain why the community should be concerned about plutonium in the soil at Rocky Flats, why the study is being done, what has been learned so far, and what is planned for the future. Panel members and RAC representatives will be on-hand to answer questions and further explain the ongoing work. There will also be time for public comments and questions. For additional information regarding the meeting or the study, please contact Carla Sanda, Advanced Integrated Management Services, Inc., at 303-277-0753.

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Radionuclide Soil Action Level Oversight Panel



Public Meeting Reminder

The following display ad ran in the weekly Sentinel/Transcript published on March 4 in seven metro communities. It also ran in the Boulder Daily Camera on February 27 & 28 and March 7 and March 10:



Radionuclide Soil Action Levels Oversight Panel



PUBLIC MEETING

"Planning for Tomorrow. . . Radionuclide Soil Action Levels at Rocky Flats"

Where: Westminster City Hall
4800 W. 92nd Avenue (East of Sheridan Blvd. On 92nd Ave.)
Westminster, CO 80030

When: Wednesday, March 10, 1999
6:30 - 7:00 P.M. Open House — 7:00 - 9:00 P.M. Discussion

- What is a "Radionuclide Soil Action Level"?
- What's the Issue?
- Why Be Concerned About Plutonium In the Soil at Rocky Flats?
- What's Being Done to Protect the Community?

Get the answers to these questions and more. Your input is needed as we work together to determine the amount of radioactive materials that may remain in the soil. Please join us for this important discussion. For more information, please contact either Carla Sanda, Advanced Integrated Management Services, Inc. (303-277-0753), or Ken Korkia, Rocky Flats Citizens Advisory Board (303-420-7855).

RSALOP TECHNICAL DISCUSSION

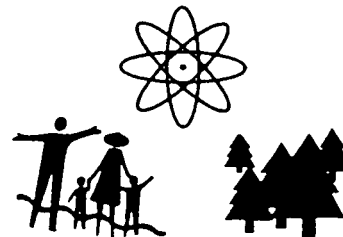
RAC representatives will be available from 2:30 - 3:30 p.m. Thursday, March 11, 1999 at the Broomfield City Building - Bal Swan Conference Room for in-depth technical discussions immediately prior to the regularly scheduled meeting.

CHECK OUT THE RSALOP WEB SITE

www.rfcab.org/SALOP.html



Radionuclide Soil Action Level Oversight Panel



March 2, 1999

Jessie M. Roberson, Manager
U. S. Department of Energy - Rocky Flats Field Office
PO Box 928
Golden, CO 80402

Dear Jessie:

Work is progressing well on the technical review of the radionuclide soil action levels. *Risk Assessment Corporation* has submitted the Task 1 Report - *Cleanup Levels at Other Sites* for Panel review and comments. The Task 2 Report - *Computer Models* is forthcoming and will be transmitted to our newly formed Peer Review Team on March 12. Overall, the project is right on schedule but with considerable work remaining.

We would like to invite you to our first public meeting scheduled for Wednesday, March 10, 1999 from 6:30 - 9:00 p.m. at the Westminster City Hall. Enclosed is a copy of the agenda for your review. We look forward to introducing the project to the community at large and inviting their participation as we work through the remainder of the technical study. Informational materials have been developed to provide a brief project background to meeting attendees, including the enclosed fact sheet entitled *Planning for Tomorrow...Radionuclide Soil Action Levels at Rocky Flats*.

Panel members appreciate your support of their work on this project and hope that you can join us next week. We look forward to seeing you then!

Sincerely,

A handwritten signature in cursive script, reading "Hank Stovall".

Hank Stovall, Co-Chair
Steering Committee
RF Soil Action Level Oversight Panel
(303) 466-5986

A handwritten signature in cursive script, reading "Mary Harlow".

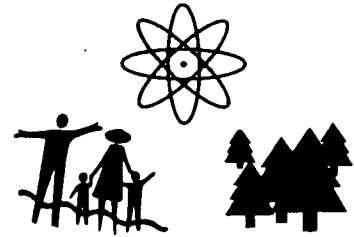
Mary Harlow, Co-Chair
Steering Committee
RF Soil Action Level Oversight Panel
(303) 430-2400 - Ext. 2174

Enclosures:
As Stated

cc:
RSALOP Members



Radionuclide Soil Action Level Oversight Panel



MINUTES OF PUBLIC MEETING

Radionuclide Soil Action Levels Oversight Panel
March 10, 1999 - 6:30 p.m. - 9:00 p.m.
Westminster City Hall

ATTENDEES

Hank Stovall, City of Broomfield
Tim Rehder, US EPA
Dave Shelton, Kaiser-Hill
Carla Sanda, AIMSI
Patrick Etchart, DOE-RFFO
LeRoy Moore, RMPJC
Todd Margulies, TM Consulting
Jelen Grogan, RAC
Nick DiSalvo, DOE-RFFO
Carl Spreng
Jeremy Kohler
Jared Obstfeld
Russell McCallister, DOE-RFFO

Mary Harlow, City of Westminster
Laura Till, Facilitator
Victor Holm, RFCAB
Ken Starr, JEFFCO
Tom Marshall, RMPJC
Doug Young, Office of Cong. Udall
John Till, RAC
Greg Murray
Matt Archer
Mark Husted
John Krigbrum
Sam Dixon, City of Westminster
Len Ackland, CU

Niels Schonbeck, HAP & MSCD
Brady Wilson, RFCAB Staff
Ken Korkia, RFCAB
Laura Brooks, Kaiser-Hill
Joel Selbin, CU-Boulder
Barb McTurk, Office of Sen. Allard
Art Rood, RAC
Roman Kohler
Susan Archer
V. Kohler
Sean McMurray
Howard Bachman
Anna Corbett, AIMSI

PROJECT OPEN HOUSE

Prior to the formal public meeting, a project open house was set up in the foyer of the Westminster City Hall. The Open House consisted of seven 24" x 36" storyboards placed on easels which briefly provided background information and project basics for meeting attendees. Three members of the Panel were on-hand to greet meeting attendees and provide further explanations of the storyboard information, if needed. An information table was also available with the following materials: press packets, project fact sheet entitled **"Planning for Tomorrow.....Radionuclide Soil Action Levels at Rocky Flats"**, storyboard text, and copies of the evening's presentation entitled: **"A Review of the Radionuclide Soil Action Levels at the Rocky Flats Environmental Technology Site"**.

AGENDA REVIEW

Laura Till, Facilitator, called the meeting to order at 7:00 p.m., reviewed the Agenda, and introduced the Panel Co-Chairs: Hank Stovall and Mary Harlow

PROJECT INTRODUCTION/BACKGROUND - Discussion Leads: Hank Stovall & Mary Harlow, RSALOP Co-Chairs

Hank Stovall welcomed meeting attendees to the first public meeting held by the Radionuclide Soil Action Level Oversight Panel (RSALOP) scheduled to introduce the community to the ongoing technical review of soil action levels at Rocky Flats. Mr. Stovall began with a brief project background including the former mission of the site, the current challenge related to determining the amount of radionuclides that may legally remain in the soil at Rocky Flats after cleanup, formation of the

Panel and the ongoing work with *Risk Assessment Corporation (RAC)* to review earlier recommendations for soil action levels. He briefly reviewed the information on the storyboards and then introduced Mary Harlow.

Ms. Harlow expressed her appreciation to the members of the RSALOP and asked them to introduce themselves to meeting attendees. Ms. Harlow continued with additional information on Panel formation, including the concerns felt by surrounding communities and residents regarding establishing soil action levels for future generations that may live on or near the Rocky Flats facility.

PROJECT OVERVIEW *- Discussion Lead: Dr. John Till, *Risk Assessment Corporation*

*Copies of the presentation may be obtained by calling Anna Corbett, AIMS, 303-456-0884

Dr. John Till began his presentation with introduction of RAC team members Arthur Rood and Dr. Helen Grogan. Dr. Till then discussed the approach the RAC team will take for the ongoing technical review of the soil action levels. He stressed that first and foremost, this work is intended to be a PUBLIC study of the soil action levels and will be conducted with total independence. RAC will take direction from Panel members who represent the community at large. Dr. Till added that they are approaching the study with no preconceived notions of what a "correct" number should look like for the soil action levels. Their work began in October 1998, with completion scheduled for November 1999 and will consist of five primary tasks:

- Assessing radionuclide soil action levels established for other sites
- Analyzing the computer modeling program used to set interim levels and assessing other relevant computer programs
- Analyzing inputs and assumptions for the soil action levels
- Making independent calculations for the soil action levels
- Recommending an appropriate soil sampling program

Early decisions must be made regarding key elements of the analysis, such as the basis of risks, scenarios address, and uncertainties. RAC representatives will work closely with the RSALOP to provide them with the necessary tools to help make those decisions. Both RAC and Panel members have a commitment to approach the study without bias.

Dr. Till then reviewed the project's eight tasks and discussed basic approaches and formulas that would be used throughout the study. In addition, he shared information regarding scenario development and existing computer programs that would be reviewed and evaluated for the project.

PUBLIC COMMENT AND QUESTIONS

Will the study consist of a table that clearly discusses the differences between the original and current evaluation?

Several task reports will be developed throughout the study that will discuss ongoing findings for each of the tasks. A final report will be issued at the completion of the study that will recap the findings of this study in relationship to the original recommendations completed in October 1996.

Are you aware of any residual radiation standards anywhere else in the world?

The ICRP is currently trying to formulate standards; however, it is important to realize that many other countries throughout the world take a more liberal approach to this issue than the United States. Frankly, international standards are currently in a state of disarray, with no single established value.

What is a safe level of radiation exposure?

The bottom line is: there is no absolutely safe level; i.e., a level that carries absolutely no risk. However, standards have been established that are generally not harmful to the general population.

What is resuspension?

In the context of this study, resuspension is a term meaning dirt or soil that has been picked up and moved to another place, which means that contaminated soils can be found at considerable distances from their origination point.

Will RAC use work that has not yet been documented?

Any material used for this study will be clearly referenced including sources, peer review, etc. Since this study is dealing with issues that are not yet being addressed anywhere else, it is important that a careful approach be taken to assure that all findings are clearly documented. In addition, a 5-member nationally known peer review team has been organized by the Panel to review and provide comments to each of the draft task reports generated by RAC on this project.

Several comments were made from the audience regarding cumulative effects of radiation that were not entirely accurate; however, given the time constraints of the evening, Dr. Till did not individually address misconceptions that may have been presented by meeting attendees.

PUBLIC PARTICIPATION OPPORTUNITIES

Hank Stovall and Mary Harlow invited the community's input throughout every step of the process. The Oversight Panel meets regularly to represent the community in this important effort. Meeting attendees were invited to:

- Participate in monthly work sessions: 4-7 p.m. - second Thursday of each month through November 1999 at the Broomfield City Building, One Descombes Drive, Broomfield, CO
- Attend public meetings
- Share comments and/or concerns with Panel members

Two additional public meetings will be scheduled for the project and will be advertised in local newspapers. In addition, meeting attendees were encouraged to add their name and address to the sign-in sheet so that they will be added to the project's mailing list. The meeting was closed with appreciation from the Co-Chairs to meeting attendees for their interest and to Panel members for their ongoing commitment to the project.

MEETING WAS ADJOURNED AT 9:00 P.M.

12

What Is the RSALOP?

Formed in 1998, the Radionuclide Soil Action Levels Oversight Panel (RSALOP):

- Is a Citizen Oversight Group comprised of a cross-section of thirteen community representatives
- Is funded by the Department of Energy to review calculations used in setting the radionuclide soil action levels for Rocky Flats
- Seeks to assure ongoing community understanding
- Holds monthly public meetings to review the study's progress and to make recommendations
- Invites community input



Radionuclide Soil Action Levels Oversight Panel

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What is a

"Radionuclide Soil Action Level"?

One of the primary concerns of site officials, regulators, and residents of surrounding communities is determining the amount of radionuclides that may legally remain in the soil at Rocky Flats following site remediation. These levels are known as "***radionuclide soil action levels***" (***RSALs***) because remediation is triggered if radiation levels in the soil exceed the established level.



Radionuclide Soil Action Levels Oversight Panel

What's the Issue?

- Interim levels for radionuclides in soils -- or "radionuclide soil action levels" (RSALs) -- for Rocky Flats were established in 1996.
- The Rocky Flats RSALs appeared to be considerably higher than those set for sites elsewhere in the world.
- This prompted concerned citizens to ask:
 - How and why were the current Rocky Flats RSALs established?
 - Should interim levels adopted for Rocky Flats be revised?

In response to these concerns, the U.S. Department of Energy agreed to the creation of the RSALOP.

What's Being Done?

- The Radionuclide Soil Action Levels Oversight Panel was convened in January 1998.
- The Panel contracted with *Risk Assessment Corporation (RAC)* to review and assess the process used to determine interim radionuclide soil action levels.
- The Panel organized a peer review team to review draft reports provided by *RAC*.
- All study results and recommendations, including public comments, will be provided to the Department of Energy and its regulators for use in determining radionuclide soil action levels for the Rocky Flats site.



Radionuclide Soil Action Levels Oversight Panel

Project Overview

- *Risk Assessment Corporation* began work in October 1998 -
 - with completion scheduled for November 1999.
- Study consists of five primary tasks:
 - Assessing radionuclide soil action levels established for other sites
 - Analyzing the computer modeling program used to set interim levels and assessing other relevant computer programs
 - Analyzing inputs and assumptions for the soil action levels
 - Making independent calculations for the soil action levels
 - Recommending an appropriate soil sampling program



You're Invited . . .

The Oversight Panel meets regularly to represent you and your community in this important effort. Your input and participation is important to the process. You can:

- Participate in monthly work sessions: 4-7 p.m. - second Thursday of each month through November 1999 at the Broomfield City Building, One Descombes Drive, Broomfield, CO
- Attend public meetings
- Share your comments and/or concerns with panel members



Radionuclide Soil Action Levels Oversight Panel

Why Be Concerned About Plutonium?

Plutonium, the material of principal concern at Rocky Flats:

- Has a half-life of 24,000 years (remains radioactive for a quarter of a million years)
- Has been released into the environment around Rocky Flats in particle form
- Emits alpha radiation which cannot penetrate skin but which can cause harm if taken into the body
- Can be inhaled, ingested, or admitted into the body through a wound
- Is subject to movement with water or resuspension in the air if present in the soil



Radionuclide Soil Action Levels Oversight Panel

"A REVIEW OF THE RADIONUCLIDE SOIL ACTION LEVELS AT THE ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE"

John E. Till

Risk Assessment Corporation



BACKGROUND INFORMATION RELATED TO THE STUDY

- ⊙ Public study
- ⊙ Independence
- ⊙ Approach to the study
- ⊙ Tasks and schedule



APPROACH TO THE STUDY

- ⊙ Early decisions must be made with regard to key elements of the analysis such as the basis of risks, scenarios addressed, and uncertainties.
- ⊙ It is our responsibility to provide the Oversight Panel with the tools to help make these decisions.
- ⊙ The Oversight Panel and the contractor must approach the study without bias.



$$\text{Dose} = (S \cdot T \cdot E \cdot D)_{uvcp}$$

where,

S = source term (characterization of the quantity, type, and temporal distribution of the material released),
T = environmental transport and fate of contaminants,
E = exposure factors (characteristics of individuals exposed),
D = dose conversion factors
u = uncertainty,
v = validation,
c = communication of results, and
p = public participation.



$$S = \frac{\text{Dose}}{(T \cdot E \cdot D)_{uvcp}}$$

where,

S = activity in soil that will yield the prescribed dose
Dose = 15 or 85 mrem in a year
T = environmental transport and fate of contaminants,
E = exposure factors (characteristics of individuals exposed),
D = dose conversion factors
u = uncertainty,
v = validation,
c = communication of results, and
p = public participation.



PRIMARY STUDY OBJECTIVE

"To estimate activity levels of man-made radionuclides (e.g. Pu, Am) in soil due to operations at the Rocky Flats Environmental Technology Site such that subsequent human exposure during future use of the site does not result in levels of radiation dose and risk that exceeds specified limits."



PROJECT TASKS

- ⊙ Task 1: Cleanup levels at other sites (draft report submitted)
- ⊙ Task 2: Computer models to calculate soil action levels (draft report submitted)
- ⊙ Task 3: Inputs and assumptions (draft report July 8)
- ⊙ Task 4: Methodology for determining soil action levels (presented to the panel)



PROJECT TASKS (Continued)

- ⊙ Task 5: Independent calculation (draft report September 8)
- ⊙ Task 6: Protocols (draft report May 8)
- ⊙ Task 7: Interaction with Actinide Migration Panel (ongoing)
- ⊙ Task 8: Public Interaction (ongoing)



TASK 1: SOIL ACTION LEVELS AT OTHER SITES

"It is important to understand the different cleanup goals among the different sites."

- ⊙ Some have calculated a proposed cleanup level based on an annual dose assumed to be protective of the public
- ⊙ Others have calculated an estimated dose based on achievable cleanup levels or existing soil concentrations



EXAMPLES OF SOIL ACTION LEVELS AT OTHER SITES

<u>Location</u>	<u>Pu-239 Soil action level (pCi/g)</u>	<u>Dose (mrem)</u>
Rocky Flats	1429	85
Hanford	35	15
Nevada Test Site	326	78.3
Johnston Atoll	17	20
Maralinga	280*	500
Palomares	1230	100

*Predicted from the Australian Radiation Lab calculation for a residential scenario receiving a dose of 500 mrem, the publicly accepted dose for the site



NORMALIZED SOIL ACTION LEVELS

<u>Location</u>	<u>Soil action level to dose ratio</u> <u>[(pCi/g)/mrem]</u>
Rocky Flats	17
Hanford	2.3
Nevada Test Site	4.1
Johnston Atoll	0.85
Maralinga	0.56
Palomares	12.3



WE ARE TAKING A NEW, STOCHASTIC APPROACH, TO CALCULATING THE RSALS

- ⊙ Data and parameters are represented by probability distributions rather than single values
- ⊙ Uncertainty about a parameter's true value is reflected in its probability distribution
- ⊙ Results are expressed in terms of probability statements about the computational endpoint



ACCOUNTING FOR UNCERTAINTY

- ⊙ In the past, we have represented mathematical quantities with simple equations, such as:

$$a \times b = c$$

- ⊙ We have typically assumed that values such as a and b were constant, giving us a constant value for c .



ACCOUNTING FOR UNCERTAINTY

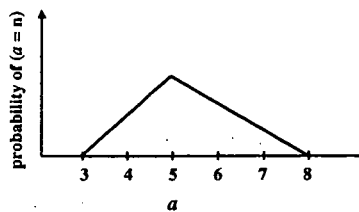
- ⊙ Let's say that we knew that the value of a was 5, and the value of b was 10, giving us a value for c of 50.

- ⊙ But we have also seen values for a such as 3, 4, 7, and 8.



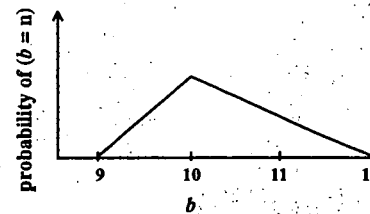
ACCOUNTING FOR UNCERTAINTY

- ⊙ So, we can represent the value of a with a distribution, or range of possible values



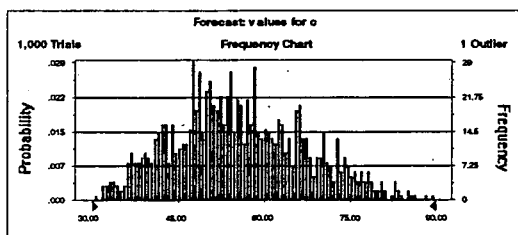
ACCOUNTING FOR UNCERTAINTY

- ⊙ In the same way, we know that b can also be 9, 11, or 12, so we represent b with a distribution.



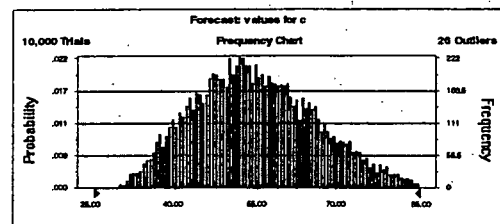
ACCOUNTING FOR UNCERTAINTY

- ⊙ Then, by randomly selecting values for a and b from their distributions, based on the probability of each value, we can calculate c many times to produce a distribution of values for c .



ACCOUNTING FOR UNCERTAINTY

- ⊙ Then, the more times we calculate the value of c , the smoother the distribution appears, and the better our estimate gets.

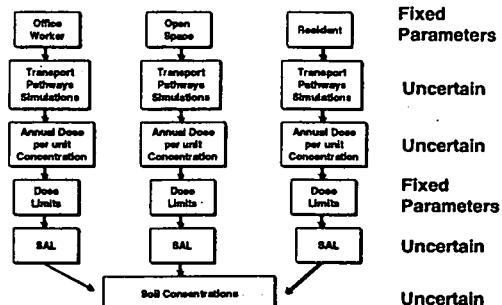


EXAMPLES OF SOURCES OF UNCERTAINTY

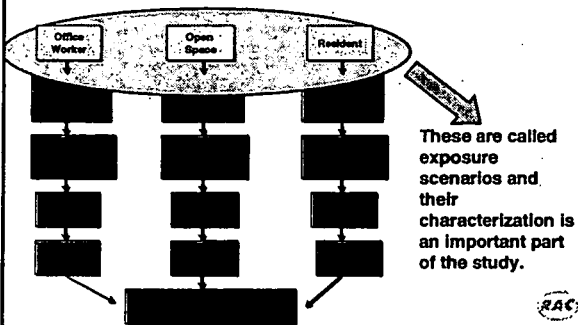
- Concentrations of radionuclides in the soil (new measurements or analysis of existing data)
- Parameters of transport models (mass loading for resuspension, particle size distributions, leaching rates for movement of radionuclides downward in soil)
- Scenarios are not considered uncertain — they represent standards for comparison

RAC

SOME PARAMETERS ARE FIXED AND SOME ARE UNCERTAIN



SOME PARAMETERS ARE FIXED AND SOME ARE UNCERTAIN



WHAT IS AN EXPOSURE SCENARIO?

- An exposure scenario is a profile of a hypothetical individual living or using the Rocky Flats site with particular characteristics and a defined lifestyle
- The scenario may refer to a succession of hypothetical individuals over time (for example, 1000 years)
- A goal for designing the scenarios in this study is that if the hypothetical individual living on or using the site are protected, then it is reasonable to assume that others will be protected

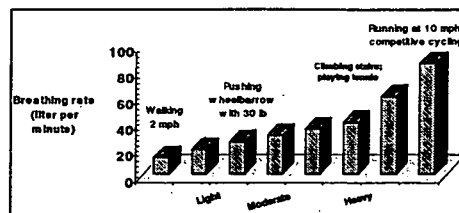
RAC

EXAMPLES OF SCENARIO PARAMETERS

- Breathing rates for various activity levels and ages
- Soil Ingestion rates
- Fraction of time spent indoors and outdoors
- Age

RAC

BREATHING RATE INCREASES WITH THE LEVEL OF WORK



From US EPA EPA/600/8-85-009 1985

RAC

EXAMPLES OF PROPOSED SCENARIOS

- Resident rancher leads an active life at the site, is at his home most of the year, spends about 40% of time outdoors, and grows a garden.
- The annual breathing rate is based on selecting appropriate breathing rates for the time spent doing heavy or light activity, and resting
- The potential exposure for this person includes inhalation; eating produce from garden irrigated with some water from site stream; direct soil ingestion from outdoor activities; and direct gamma exposure from the soils.

RAC

TASK 2: COMPUTER CODES

● Computer Codes Evaluated Were

- MEPAS (Pacific Northwest Laboratory)
- MMSOILS (EPA)
- D&D (NRC)
- GENII (Pacific Northwest Laboratory)
- RESRAD (Argonne National Laboratory)

● Codes were evaluated based on:

- ability to perform Monte Carlo simulations as our proposed approach dictates
- inclusion of all relevant pathways

RAC

MMSOILS and MEPAS

- MEPAS was dismissed from consideration because the source code is not available and therefore, may not be configured for Monte Carlo simulation
- MMSOILS was dismissed from consideration because it does not model decay and ingrowth of radioactive progeny

RAC

DandD

- DandD (Version 1.0) has not gone through extensive testing or use
- Source code and documentation currently not available
- Many parameters, including dose conversion factors are "hardwired" and not subject to change
- In a benchmark exercise, DandD calculated dose to soil ratios that were considerably higher than RESRAD

RAC

GENII

- The GENII code package included source term and documentation
- GENII includes models for all relevant pathways. Offsite transport via the airborne pathway is included in the model.
- Soil Action Levels were calculated with GENII and compared with those calculated by RESRAD

RAC

RESRAD

- Several versions of RESRAD are in use
 - Version 5.61 was used to develop the proposed soil action levels
 - Source code for the current version (5.82) was obtained and evaluated
 - Version 5.82 has a revised resuspension algorithm that results in a decrease in the dose-to-source ratio by a factor of 6 and a corresponding increase in the soil action level

RAC

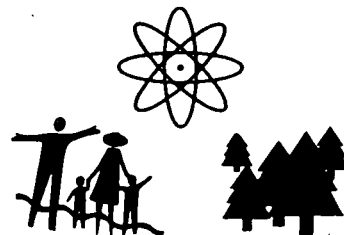
CONCLUSIONS

- ⊗ Public study — oversight panel's role is critical and unique.
- ⊗ RAC's approach is different from that taken previously at Rocky Flats and at other sites.
- ⊗ Key tasks remain to be done but we are working toward completion of the study by the end of the year.





Radionuclide Soil Action Level Oversight Panel



MEETING EVALUATION

RSALOP Public Meeting - March 10, 1999
Westminster City Hall - City Council Chambers
6:30 - 9:00 P.M.

*Please provide a numerical rating from 1 - 5 to the following questions:
(1 = lowest rating / 5 = highest rating)*

1. Did the meeting provide a good understanding of the issue that the Radionuclide Soil Action Levels Oversight Panel is addressing?

1 2 3 4 5

2. Was the written information in the foyer helpful to your overall understanding of the issue:

Storyboards in Foyer:

1 2 3 4 5

Fact Sheet:

1 2 3 4 5

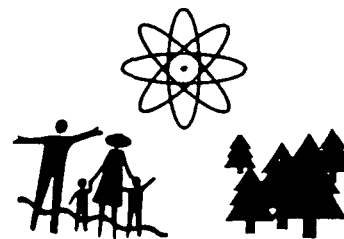
3. Were the presentations helpful and understandable?

1 2 3 4 5

4. Do you have any suggestions for improvements to the meetings and/or written information?



Radionuclide Soil Action Level Oversight Panel



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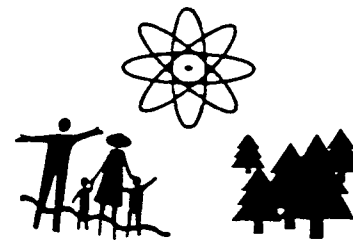
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Radionuclide Soil Action Level Oversight Panel



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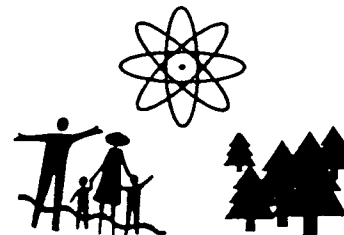
1 2 3 4 5

4. Do you have any suggestions for improvements to the meetings and/or written information?

Thank you for taking time to speak at a basic level.



Radionuclide Soil Action Level Oversight Panel



MEETING EVALUATION

RSALOP Public Meeting - March 10, 1999
Westminster City Hall - City Council Chambers
6:30 - 9:00 P.M.

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(1 = lowest rating / 5 = highest rating)

1. Did the meeting provide a good understanding of the issue that the Radionuclide Soil Action Levels Oversight Panel is addressing?

1 2 3 4 (5)

2. Was the written information in the foyer helpful to your overall understanding of the issue:

Storyboards in Foyer:

1 2 3 (4) 5

Fact Sheet:

1 2 3 (4) 5

3. Were the presentations helpful and understandable?

1 2 3 4 (5)

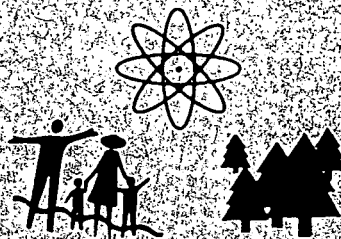
4. Do you have any suggestions for improvements to the meetings and/or written information?

Dr John Till did a great job.



Best Available Copy

Radionuclide Soil Action Level Oversight Panel



AGENDA

Public Meeting - March 10, 1999 - 6:30 - 9:00 P.M.
Westminster City Hall - City Council Chambers

6:30 - 7:00

Project Open House - Foyer

7:00 - 7:10

Welcome/Agenda Review

Laura Till, Facilitator

7:10 - 7:30

Project Introduction/Background

Mary Harlow, Co-Chair
Hank Stovall, Co-Chair

7:30 - 8:30

Project Overview

Risk Assessment Corporation (RAC)

- Task 1 - Cleanup Levels at Other Sites
- Task 2 - Computer Models
- Task 3 - Inputs & Assumptions
- Task 4 - Methodology
- Task 5 - Independent Calculation
- Task 6 - Sampling Protocols

Dr. John Till, President
Arthur S. Rood
Dr. Helen Grogan

Status Report on Work to Date

- Computer Modeling
- Project Scenarios

8:30 - 8:45

Public Comments/Questions

Facilitator

8:45 - 9:00

Public Participation Opportunities

Co-Chairs

- Monthly Meetings
- Community Briefings
- Public Meetings

Wrap-Up/Thank you

Co-Chairs

UPCOMING MEETINGS/ACTIVITIES

March 11

RSALOP Monthly Meeting

4:7 P.M. Broomfield City Building

April 8

RSALOP Monthly Meeting

4:7 P.M. Broomfield City Building

May 13

RSALOP Monthly Meeting

4:7 P.M. Broomfield City Building

June 10

RSALOP Monthly Meeting

4:7 P.M. Broomfield City Building

July 8

RSALOP Monthly Meeting

4:7 P.M. Broomfield City Building

August 12

RSALOP Monthly Meeting

4:7 P.M. Broomfield City Building

September 9

RSALOP Monthly Meeting

4:7 P.M. Broomfield City Building

October 14

RSALOP Monthly Meeting

4:7 P.M. Broomfield City Building

November 11

RSALOP Monthly Meeting

4:7 P.M. Broomfield City Building

IMPORTANT NOTE: TECHNICAL DISCUSSIONS ARE SCHEDULED FROM 2:30 - 3:30 IN THE BAL SWAN
CONFERENCE ROOM - ADJACENT TO ZANG'S SPUR - PRIOR TO ALL MEETINGS

*Broomfield City Building, One Descombes Dr. - Zang's Spur/Bal Swan Conference Rooms (lower level)

NEWS RELEASE

For Immediate Release

Contact: Carla Sanda, AIMS
(303) 277-0753

HOW MUCH IS "*TOO MUCH*" PLUTONIUM IN ROCKY FLATS SOILS?

WESTMINSTER, Colo., March 5, 1999 --National attention is focusing on a study currently underway regarding soil cleanup levels for Rocky Flats, the former nuclear weapons production plant located in Jefferson County. A public meeting is scheduled from 6:30 - 9:00 p.m. on Thursday, March 10 at the Westminster City Hall, 4800 W. 92nd Ave., Westminster, CO. The evening will begin with a 30-minute open house designed to provide background information, followed by briefings regarding the progress to date and future goals for the study.

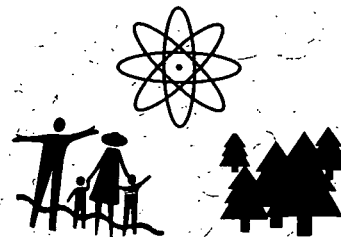
As Rocky Flats moves closer to final remediation goals, one of the primary challenges facing site officials and residents is determination of the amount of radionuclides, such as plutonium, that may legally remain in the soil following remediation. These levels are known as "radionuclide soil action levels" because remediation is triggered when the amount of radioactive material in the soil exceeds established levels. A cleanup agreement negotiated in 1996 between site officials and its regulators set interim levels for plutonium and other contaminants that could remain in the soil at the site. Some members of the community, however, believed that those interim levels were too high. As a result, the Department of Energy agreed to fund a citizen-directed, independent review of the calculation of the soil action levels. To provide oversight of the study, the Radionuclide Soil Action Levels Oversight Panel (Panel) - comprised of scientists, local government representatives and citizens - was formed in 1998. After a formal bidding process, the Panel selected *Risk Assessment Corporation (RAC)* to conduct the technical review. Work has been proceeding since last fall and is scheduled for completion in November 1999.

This public meeting is the first of three to be scheduled throughout the course of the project. Briefings will explain why the community should be concerned about plutonium in the soil at Rocky Flats, why the study is being done, what has been learned so far, and what is planned for the future. Panel members and RAC representatives will be on-hand to answer questions and further explain the ongoing work. There will also be time for public comments and questions. For additional information regarding the meeting or the study, please contact Carla Sanda, Advanced Integrated Management Services, Inc., at 303-277-0753.

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Radionuclide Soil Action Level Oversight Panel



Planning for Tomorrow...

Radionuclide Soil Action Levels at Rocky Flats

BACKGROUND

Rocky Flats operated from 1952 - 1992 as a manufacturing facility for the production of component parts for nuclear weapons, including plutonium pits, the fissionable core of such weapons. Since cessation of production activities, the site has been involved in waste management and environmental remediation activities. One of the primary challenges facing site officials and residents from surrounding communities is determination of the amount of radionuclides, such as plutonium, that may legally remain in the soil following remediation. These levels are known as "radionuclide soil action levels" (RSALs) because remediation action is triggered when the amount of radioactive material in the soil exceeds the established levels.

Using a computer-modeling program known as RESRAD (Residual Radiation) that was developed at Argonne National Laboratory, interim radionuclide soil action levels were incorporated into the Rocky Flats Cleanup

Agreement (RFCA) on October 18, 1996. The RFCA serves as the legally binding agreement for site remediation between the Department of Energy and its regulators — the Environmental Protection Agency and the Colorado Department of Public Health and Environment. Intended to be protective of people using the site after closure, the RSALs set the upper limits for the radionuclides (primarily plutonium and americium) allowed in the soil at Rocky Flats after remediation. The RSALs are measured in picocuries (a measure of radiation) per gram of soil.

Almost immediately after the RSALs were established, members of the community became concerned. Not only were the numbers much higher than anticipated, but upon further investigation the levels were found to be higher than levels established for remediation at sites elsewhere, as shown below:

Location	Action Level for Plutonium (in picocuries per gram of soil)
Rocky Flats Environmental Technology Site	1,429
Nevada Test Site	200
Eniwetok Atoll (South Pacific bomb test site)	40
Hanford Nuclear Reservation (Washington State)	34
Johnston Atoll	15

PUBLIC REACTION

After looking at the above numbers, it became apparent that more information was needed to better understand the criteria used for the soil action levels. As a result, several entities, including the Rocky Flats Citizens Advisory Board, the cities of Westminster and Broomfield, public interest groups, and Congressman David Skaggs called for an independent assessment of the RSALs as well as the process used to establish those levels. The end result of ensuing discussions was an unprecedented agreement by the Department of Energy to fund a community-directed, independent scientific assessment of the RSALs for Rocky Flats. To provide

oversight of the study, a panel of thirteen community representatives was formed, known officially as the Radionuclide Soil Action Levels Oversight Panel (RSALOP).

After drafting and issuing a formal Request for Proposals, the Panel selected Risk Assessment Corporation (RAC) to conduct the assessment. RAC has previous experience with the Rocky Flats site studying the potential health effects caused by site emissions during production years. In addition, RAC has more than twenty years experience working on dose

reconstruction, environmental dosimetry, chemical risk analysis and related disciplines. RAC has assembled a team of technical experts, each with a particular area of expertise necessary to complete the RSAL assessment. Work began in October 1998 and is scheduled for completion in November 1999.

PROJECT SUMMARY

Several project tasks have been defined for the contractor. The first of these is to research RSALs used at other plutonium-contaminated sites around the world. Second, RAC is tasked with exploring existing computer models that could be used to determine RSALs and recommending the one best suited for use at Rocky Flats. Third, RAC will investigate and then recommend pertinent inputs and assumptions for use in computer calculations. Fourth, with the preceding information, RAC's major task will be to conduct an independent calculation of the RSALs for Rocky Flats, which can then be compared with the originally recommended RSALs. The final two tasks involve recommending appropriate soil sampling procedures to determine the amount of contamination in soil both before and after remediation activity. Finally, RAC will analyze results from the

ongoing Actinide Migration Studies to determine whether any findings from these studies are applicable to the soil action levels.

PUBLIC INVOLVEMENT

Although public involvement began when community representatives approached the Department of Energy with concerns that resulted in formation of the RSALOP, the Panel has developed a public involvement and information strategy to ensure ongoing communication. Monthly working meetings of the Panel are open to the public and are conducted the second Thursday of each month from 4-7 p.m. at the Broomfield City Center, One Descombes Dr., Broomfield, CO. In addition, three public information workshop/meetings will be scheduled during the project. With some up-front planning, a member of the Panel can provide briefings to community groups or interested parties. For a project status update, information packet, or further information on meeting times and locations, please contact either Carla Sanda, Advanced Integrated Management Services, Inc., at (303) 277-0753 or Ken Korkia, Rocky Flats Citizens Advisory Board, at (303) 420-7855.

Introducing the RSALOP Team...

Panel Co-Chairs

Mary Harlow serves as the Rocky Flats Coordinator for the City of Westminster, acts as the City liaison to other City, County, State and Federal organizations relative to Rocky Flats activities, and keeps the City Council and staff apprised of pertinent site issues. She represents the City staff on the Rocky Flats Coalition of Local Governments Board of Directors and is currently Secretary for the Rocky Flats Citizens Advisory Board. Additionally, she serves on the Board of Directors of the Energy Communities Alliance, a national organization of local communities that are located in the shadow of Department of Energy facilities. Ms. Harlow has a BS in Health Care Management, an AAS in Environmental Technology and an AS in Water/Wastewater Technology.

Henry A. Stovall earned a BS in Industrial Education and a BS in Physics. Prior to retirement, he was an Engineering Manager with 33 years experience in the engineering arena, including environmental health and safety engineering. Mr. Stovall serves as a member of the Rocky Flats Health Advisory Panel and has been actively involved in related Rocky Flats issues. As a twenty-nine year resident of Broomfield, Colorado, Mr. Stovall has been active in various community activities, including serving on the Broomfield City Council from 1977 - 1993 and again from 1995 - present.

Panel Members

Tom Davidson received his BS in Electronic Engineering and has thirty years of engineering experience, including 16 years in the nuclear field. He is a member of the Rocky Flats Citizens Advisory Board and has participated in numerous issues related to the cleanup and future use of the site. Mr. Davidson is also an active participant in the University of Colorado at Boulder Chancellor's Community Advisory Council. He currently serves as the Mayor of Louisville, Colorado and represents his community on the Panel.

Joe Goldfield earned his BS in Chemical Engineering and achieved professional affiliation with the American Academy of Environmental Engineers as a Diplomat. His professional career with Manville Corporation spanned thirty-one years, of which 20 years was spent as manager of Environmental Engineering. He holds a Professional Engineers' license in New Jersey, Colorado, Massachusetts, and Mississippi and

owns several patents on pollution control devices. Mr. Goldfield has been an active stakeholder in numerous issues at the Rocky Flats site.

Dean Heil is currently Assistant Professor of Soil Chemistry in the Department of Soil and Crop Sciences at Colorado State University. He completed his Ph.D. in Soil Science at the University of California at Berkeley. His past research includes remediation of Pb (lead) polluted soils.

Robert Kanick earned a BS in Nuclear Engineering with an emphasis in reactor/power operations. His experience as a reactor engineer and core designer has provided valuable experience ranging from the development and oversight of reactor testing and control of special nuclear materials, to the use and evaluation of computer modeling systems used for core design, safety and criticality analysis. As a member of the

Rocky Flats Citizens Advisory Board. Mr. Kanick has been actively involved in numerous projects related to the cleanup and future use of the Rocky Flats site.

Carol E. Lyons serves as the Rocky Flats Coordinator for the City of Arvada, Colorado.

Todd Margulies earned his MS in Environmental Sciences/Geochemistry, as well as a Bachelor's in Geology. After spending more than ten years working for major environmental firms, he began work as an independent environmental consultant in 1991. He has dealt with numerous Rocky Flats issues and was a staff member of the Colorado Council on Rocky Flats. In addition, Mr. Margulies has conducted groundwater, surface water, soil, and sediment investigations at sites around the world to assess organic and inorganic contaminant transport and fate.

LeRoy Moore, Ph.D., serves as a consultant to the Rocky Mountain Peace and Justice Center in Boulder, Colorado. Author of the Citizens Guide to Rocky Flats (1992), Dr. Moore is a member of the Rocky Flats Citizens Advisory Board. Involved with the Rocky Flats issue since 1979, he has played a key role in numerous projects, including the Rocky Flats Future Site Use Working Group. He co-chairs the recently created Rocky Flats Actinide Migration Studies Technical Review Group. He is currently working with a photographer on a book which will tell the Rocky Flats story in images and words of workers who made bombs inside the facility and activists who opposed such production from the outside.

Lisa Morgan Morzel serves on the Boulder City Council, having been elected in 1995. As a council member, she represents Boulder on issues related to Rocky Flats, including the Rocky Flats Local Impacts Initiative and its successor group, the Rocky Flats Coalition of Local Governments. Dr. Morzel is a research geologist for the U.S. Geological Survey and holds a Ph.D. in Geology and Geophysics.

Technical Support Contractor

Since its formation in 1977, Risk Assessment Corporation (RAC) has significantly contributed to the development and application of methods for estimating exposures from radionuclides and chemicals to the public and workers and quantifying the health risks and their uncertainties. RAC has also encouraged public participation in dose reconstruction studies and has developed innovations in the communication of exposure and risk information to the public. The following team of professionals, headed by RAC's president, Dr. John E. Till, has been assembled to conduct this study:

John E. Till holds a Ph.D. in Nuclear Engineering, an MS in Health Physics, and a BS in Engineering. In addition, he is a graduate of the U.S. Naval Academy and the U.S. Naval Nuclear Propulsion Program. Following his naval career, Dr. Till worked as a staff scientist at the Oak Ridge National Laboratory, and in 1977 formed Risk Assessment Corporation (RAC). Dr. Till's scientific achievements include more than 150 publications, including editing the first textbook on radiation dose analysis, Radiological Assessment, and other documents that stress new approaches to apply and simplify risk analysis. Dr. Till's current work focuses on the assessment of risks from past releases of radionuclides and chemicals.

George G. Killough earned an MA degree in mathematics from the University of Tennessee at Knoxville and did further study under a grant from the National Aeronautics and Space Administration. His more than 30 years of professional experience include university teaching (mathematics and computer

Niels Schonbeck is a professor in the Department of Chemistry at Metropolitan State College of Denver, Colorado, where he has taught since 1978. He has also been a visiting scientist at the National Center for Atmospheric Research in Boulder, Colorado. He earned his Ph.D. in Biological Chemistry and his BA in Chemistry. In 1987 he became involved in the health and safety issues of the Rocky Flats site and was appointed to the Rocky Flats Environmental Monitoring Council. Since then he has also served as a member of the Rocky Flats Health Advisory Panel.

Joel Selbin received his BS in Chemistry and his Ph.D. in Inorganic Chemistry. He joined the faculty at Louisiana State University (Baton Rouge) in 1957, where he served until 1991. During his 34 years at LSU, he directed the research of graduate and postdoctoral students, authored and collaborated on numerous books and articles, and obtained two U.S. patents. He has written, lectured, and debated widely on nuclear power and nuclear arms issues, as well as energy alternative issues, and has served as a technical consultant to numerous academic and governmental entities. Upon his retirement from LSU, Dr. Selbin relocated to Boulder, Colorado, where he taught for seven years at the University of Colorado in Denver. He now teaches at the University of Colorado-Boulder campus.

Ken Starr has more than 13 years' experience in the fields of civil and environmental engineering including numerous CERCLA/Superfund remediation and investigation tasks, environmental assessments, environmental, health and safety assessments, as well as health and safety training. He currently serves as the Director of the Environmental Compliance Division for the Jefferson County Department of Health and Environment. He holds an MS in Environmental Engineering, a BS in Agricultural/Civil Engineering, and is a Registered Professional Engineer for both the States of Colorado and Arizona.

science) and serving as a member of the research staff at Oak Ridge National Laboratory, where he designed and implemented mathematical models and applied them to environmental problems. He developed internal dosimetry computer software, which was subsequently the basis for the Environmental Protection Agency's RADRISK program. Under sponsorship of the National Science Foundation and the Department of Energy, he constructed models of the global cycling of carbon and tritium, which were applied to estimating levels of carbon dioxide as a greenhouse gas and to predicting exposure of the world population to releases of ¹⁴C and ³H from nuclear fuel cycles. As a consultant to Risk Assessment Corporation, he participated in a dose reconstruction project for the Fernald nuclear facility, sponsored by the Centers for Disease Control and Prevention. For the Fernald study, he devised new methods for confirming estimates of airborne uranium releases from soil measurements and modeling the atmospheric diffusion of radon decay products using radon monitoring data. Mr.

Killough is author or co-author of many refereed publications. In his current work, he makes innovative use of probabilistic methods and Monte Carlo bootstrap sampling to assess uncertainties in model predictions and to calibrate environmental models to site-specific data.

Kathleen R. Meyer holds an MS degree in health physics and a Ph.D. in radiological health sciences. She has served as a research assistant at Oak Ridge National Laboratory where she assessed the radiation damage and subsequent recovery capabilities of normal tissue, both in cell culture and in animal models. Her career has also included independent work in radiological dose assessments, technical abstracting, and chemical and radiological risk evaluation for sites containing hazardous materials. Dr. Meyer has more than 20 years experience in the fields of biological research and teaching, radiation protection, and public communication.

Arthur S. Rood received his Bachelor's degree in geology and an MS in health physics. His experience includes environmental and laboratory measurements of uranium-related byproducts. He later joined a team of environmental scientists at the Idaho National Engineering and Environmental Laboratory and worked primarily in the field of environmental contaminant transport modeling and dose assessment. Mr. Rood has now formed his own corporation, and projects currently focus on the use of atmospheric dispersion models to study past releases of chemicals and radionuclides to support dose reconstruction studies at the Rocky Flats Plant and

Savannah River Site. Mr. Rood also teaches an Environmental Modeling class for the University of Idaho.

David J. Thorne received his Bachelor's degree in geology and his MS degree in health physics. His career has included surveillance of the Fort St. Vrain Nuclear Power Station, conducting studies on concentrations of ¹³¹I in dairy milk. He has also been involved in providing air quality modeling support, preparing radiological health risk assessments, conducting studies on groundwater transport of contaminants, and development of an atmospheric dispersion modeling study, as well as computer models to simulate the transport of radionuclides. Mr. Thorne is currently using his extensive experience with computer systems, computer programming languages, and contaminant transport models to test computer models, assess residual contamination in buildings, model accidental releases, develop risk-based standards, and model potential groundwater impacts.

Jill M. Weber received her undergraduate degree in 1993 in physics with minors in chemistry and mathematics and her MS degree in radiological health sciences with a specialty in health physics. Ms. Weber joined RAC in 1995 and has been involved in a number of radiological dose reconstruction projects. Her research has included model development for releases of plutonium from the 903 Pad Area at Rocky Flats, a contaminated soil area that was exposed to high winds and resulted in significant releases. She also has experience in environmental monitoring, uncertainty estimation, and public communication.

Administrative Support Contractor

Advanced Integrated Management Services, Inc. (AIMSI) is a small, minority-owned, Tennessee corporation founded in 1994 with staff of over 100 full- and part-time professionals. Headquartered in Oak Ridge, Tennessee, with field offices in Denver, Colorado, Nashville, Tennessee, and Paducah, Kentucky, AIMSI provides professional engineering, management, technical and administrative support services and has formed the following team to provide both day-to-day project administrative support and public involvement and information:

Anna Corbett has more than 15 years experience in technical support and customer service, including extensive support to programs in the nuclear and chemical waste environment. Her career with AIMSI has included support to Rocky Flats programs including the Mixed Waste Focus Area, Technology Management program, and the Rocky Flats Site Technology Coordination Group.

Carla Sanda brings more than 15 years of experience in developing and executing stakeholder involvement activities. Prior to joining AIMSI as a subcontractor on this project, Ms. Sanda was a member of the Community Relations group at Rocky Flats. She served, as team lead for waste management stakeholder involvement; project manager for the Rocky Flats Western Governors' Association Demonstration of Innovative Technologies; program manager for the Federal Facility Compliance Act stakeholder involvement; and was a member of the team tasked with drafting our national public involvement policy.

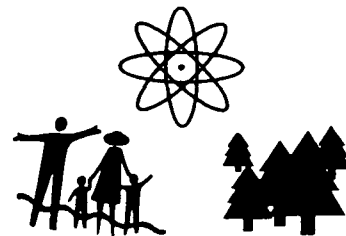
**For the latest project information on the web go to:
www.rfcab.org/SALOP.html**

**Or contact AIMSI:
5460 Ward Road, Suite 370
Arvada, CO 80002
(303) 456-0884, Fax (303) 456-0858**

Sept. 8, 1999



Radionuclide Soil Action Level Oversight Panel



AGENDA

Public Meeting – September 8, 1999 - 7:00 - 9:00 P.M.
Broomfield City Building - City Council Chambers

7:00 - 7:10	Welcome	Councilman Hank Stovall, Co-Chair
7:10 - 7:15	Agenda Review	Laura Till, Facilitator
7:15 - 7:30	Project Introduction/Background	Mary Harlow, Co-Chair
7:30 - 7:45	Project Challenges <ul style="list-style-type: none">- Scenario Development- Hot Spots- Timeframe	Hank Stovall, Co-Chair
7:45 - 8:45	Project Overview/Update	Dr. John Till, President <i>Risk Assessment Corporation (RAC)</i>
8:45 - 9:00	Public Comments/Questions	Facilitator
	Wrap-Up/Thank you	Co-Chairs

UPCOMING MEETINGS



September 9
October 14
November 11
December 9
January 13, 2000

RSALOP Monthly Meeting
RSALOP Monthly Meeting
RSALOP Monthly Meeting
RSALOP Monthly Meeting
RSALOP Monthly Meeting

4-8 P.M. Broomfield City Building*
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**IMPORTANT NOTE: TECHNICAL DISCUSSIONS ARE SCHEDULED FROM 2:30 - 3:30 IN THE BAL SWAN
CONFERENCE ROOM - ADJACENT TO ZANG'S SPUR - PRIOR TO ALL MEETINGS**

*Broomfield City Building, One Descombes Dr. - Zang's Spur/Bal Swan Conference Rooms (lower level)

CHECK OUT THE RSALOP WEB SITE: www.rfcab.org/SALOP.html

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RADIONUCLIDE SOIL ACT LEVEL OVERSIGHT PANEL
PUBLIC MEETING ATTENDEES
SEPTEMBER 8, 1999

NAME	ORGANIZATION	ADD TO MAILING LIST	MAILING ADDRESS
Greg Murray			
Roman Kohler			
Ralph Stephens			
Russell McCallister	DOE / RFFO		
John Winters		✓	
Joe Goldfield	CCANW		
Rick DiSalvo	DOE / RFFO		
Elin Rogers	RFCAB		
John Corsi	Kaiser Hill		
Niels Schaubach	Utah State College		
Rick Warner			
Joel Selbin	RSALOP		

RADIONUCLIDE SOIL ACT LEVEL OVERSIGHT PANEL
PUBLIC MEETING ATTENDEES
SEPTEMBER 8, 1999

NAME	ORGANIZATION	ADD TO MAILING LIST	MAILING ADDRESS
MRS. JOE GOLDFELD			
LeRoy Moore	RSALOP		
Mary Harlow	✓		
HANK STOVALL	✓		
Kathy SCHNORR	City of Bloomfield		
Ken Korkia	RFCARB		
Erin Rogers	RFCARB		
GARLA SANDA	CAT CONSULTING/AMSI		

Our ultimate goal for the outcome of this study can be condensed into one word:

CREDIBILITY

Not only was credibility the overriding theme in selection of Risk Assessment Corporation as the contractor, but also the Panel took it a step further and insisted that their work be peer-reviewed to enhance the project's credibility and ultimate recommendations. Last winter the Panel formed a Peer Review Subcommittee to develop a framework for the peer review effort by establishing basic criteria for members of the Peer Review Team. Each member must have

- A positive reputation and credibility within the scientific community;
- Expertise in the identified project tasks; i.e., radionuclide soil levels, analysis of RESRAD and/or other relevant computer programs; analyzing inputs/assumptions for radioactive soil action levels; assessing independent calculations for radioactive soil action levels; analysis of soil sampling protocols
- Minimal conflict of interest issues
- Ability to work within proposed timetable

With that in place, the Panel literally conducted a nationwide search resulting in selection of these five widely known individuals to serve on the Peer Review Team:

- Dr. Steven L. Simon from the National Academy of Sciences has been a member of the team dealing with contaminated sites in the Marshall Islands. He also served on the Science Advisory Board regarding uncertainty for radiogenic cancer risk

- Dr. Paula Labieniec is an independent consultant in hazardous waste and a specialist in the area of soil risk assessment
- Dr. Ward Whicker is a member of the Department of Radiological Health Sciences at Colorado State University. Many of you are probably familiar with Dr. Whicker's work – particularly his studies related to Rocky Flats
- Allan C. B. Richardson is a consultant on radiation protection and former member of the EPA team that developed much of the EPA's radiation standards;
- Dr. Glenn Paulson is the President of Paulson & Cooper (Jackson, WY & Chicago, IL), a firm widely recognized for its expertise in hazardous & radioactive waste management.

To date, the Peer Review Team has provided feedback on three draft reports and will review the Task 5 report when it becomes available.

However, the Panel didn't stop there. After Risk Assessment Corporation reviews the feedback from the Peer Review Team, their responses to that input as well as feedback from the Panel is reviewed by selected members of the Panel to assure that the comments and criticism were handled to the satisfaction of the Panel.

We've worked hard to pave the way to a credible study and will continue that path through the next few months to its conclusion.

Project Passes Mid-Point:

- Computer Model Chosen
- Key Inputs & Assumptions Identified
- Soil Sampling Protocols Reviewed
- Peer Review Team Mobilized

September 1999

PROJECT COMPRISED OF EIGHT TASKS

Work on review of the interim radionuclide soil action levels at Rocky Flats continues to move forward. As noted in the fact sheet entitled "*Planning for Tomorrow...Radionuclide Soil Action Levels at Rocky Flats*," the Radionuclide Soil Action Level Oversight Panel (RSALOP) was formed in response to concern voiced by members of the community at interim radionuclide soil action levels (RSALs) set for the Rocky Flats site. After receiving funding from the Department of Energy, the Panel contracted with *Risk Assessment Corporation (RAC)* to conduct an independent scientific assessment of the RSALs for Rocky Flats.

The project is organized into eight tasks. A final report will be published that will recap the study's findings and propose recommendations for a radionuclide soil action level (RSAL) at the Rocky Flats Site.

1. Cleanup Levels at Other Sites
2. Computer Models to Determine RSALS
3. Key Project Inputs & Assumptions
4. Methodology
5. Independent Calculation of RSALs for Rocky Flats
6. Sampling Protocol
7. Interaction with the Actinide Migration Panel
8. Public Involvement

Task 1: Cleanup Levels at Other Sites

Completed in April 1999, this report provided the Panel with a clear, unbiased evaluation and comparison of previously developed soil action levels for Rocky Flats and other sites around the world. The evaluation found that the soil action levels established for Rocky Flats are significantly higher than action or cleanup levels at other facilities, even when normalized to dose. However, the report provided a better understanding and clarification for the elevated levels and found that the calculation is strongly controlled by three basic parameters:

- Dose conversion factor (solubility class of plutonium)
- Mass loading (resuspension); and to a lesser degree
- Breathing rate

In nearly every case, differences in soil action levels between sites could be explained by the different assumptions made for one or more of the basic parameters. The Task 1 report identified the input model parameters that are of primary importance in determining soil action levels so that this information can be used as the study evolves.

Task 2: Computer Models

The goal of this report, which was finalized in July 1999, was to discuss and compare environmental assessment programs that might be used for developing soil action levels for Rocky Flats. *RAC* scientists evaluated the following five computer programs for use in the project: **RESRAD**, **MEPAS**, **GENII**, **MMSOILS**, and **DandD**. The report discusses the pros and cons of each program and provides information on the four key elements that must be considered when developing soil action levels. Based upon extensive evaluation of the available computer codes, *RAC* representatives concluded that either the **RESRAD** or **GENII** program could be used. After further discussion with Panel members, it was decided to proceed with the use of the **RESRAD** program.

"Soil Action Levels Depend on Four Key Elements:

1. How radioactive material is transported in the environment to people,
2. How people might be exposed to the radioactive materials (exposure scenarios,
3. How radiation dose to a person is assessed (radiation dosimetry), and
4. How radiation protection guidelines fit in (annual dose limits)."

Task 3: Inputs & Assumptions

After months of discussions and input from Panel members, *RAC* representatives conducted a sensitivity analysis on the inputs and assumptions required for the use of **RESRAD**. Site-specific values were derived or uncertainty distributions were created for critical parameters emerging from the sensitivity analysis. The sensitivity of each parameter was then assessed using the built-in Monte Carlo-based sensitivity analysis packaged with the latest version of **RESRAD**. This report also

includes a careful evaluation of scenarios for their applicability to potential future land uses. The report describes the process of scenario evaluation and discusses the scenarios chosen for the independent analysis of the Rocky Flats soil action levels. To develop meaningful and appropriate calculations for soil action levels at Rocky Flats, site-specific data were collected and will be used for all parameters that were revealed as sensitive to change and parameters that warranted adaptation.

Primary efforts were directed toward the most important parameters for soil action level calculations with **RESRAD**: mass loading, soil-to-plant transfer factors, distribution coefficients, area of contamination, and mean annual wind speed. Values and distributions presented in this report will be used in the calibrated version of **RESRAD**, and values for soil action level and dose will be presented as distributions of possible values for each individual scenario.

Task 4: Methodology

"Methodology" is a topic that encompasses the project as a whole through ongoing dialogue with the Panel and Community regarding proposed methodologies employed in the study. Methodologies that may be considered and/or decided upon are discussed within reports specific to project tasks. Therefore, no separate report is being published on this task.

Task 5: Independent Calculation of RSALs

Although this has been identified as "Task 5", this will be the final step in the study completed after running the RESRAD program using the Inputs & Assumptions decided upon from Task 3.

Task 6: Soil Sampling Protocols

RAC released the draft final report for Task 6 at the May 1999 Panel meeting. The document reviewed the current site sampling program and procedures as well as individual site sampling and analysis plans. It also went on to provide recommendations to the Panel for consideration in developing a sampling protocol for the site and discussed ten key elements that should be a part of any sampling protocol. Ultimately, RAC plans to recommend a specific soil sampling protocol to the Panel to determine the amount of contamination in soil following remediation. Task 6 is currently under revision, with an anticipated draft final report due in the fall of 1999.

TEN KEY ELEMENTS TO SAMPLING PROTOCOL

1. Data Quality Objectives
2. Multiple Radionuclide Consideration
3. Classification of Survey Units
4. Soil Sampling Depth
5. Sample Spacing & Methods
6. Small Areas of Elevated Activity
7. Surrogate Measurements
8. Number of Samples Based on Statistical Methods
9. Independent Confirmatory Investigations
10. Soil Sampling Quality Assurance

Task 7: Interaction with the Actinide Migration Panel

The Actinide Migration Panel is overseeing an effort begun by contractors at the Rocky Flats site in 1996. Comprised of a national task force, the group is drawing upon state-of-the-art knowledge throughout the scientific community on behavior and mobility of actinides in the environment. It is hoped that this group's efforts will help to provide information necessary to develop the best possible approach for the successful closure of the Rocky Flats site. RAC representatives, as well as numerous RSALOP members, attend regular Actinide Migration Panel meetings and are attempting to extrapolate any information gathered to assist in the independent review of the soil action levels for the Rocky Flats site. No separate formal report will be generated on this Task.



Task 8: Public Involvement

A public involvement strategy has been developed to provide regular updates to the community on the progress of this study. Panel members meet the second Thursday of each month with *RAC* representatives to review project findings and work with the contractor to set and determine criteria for key components of the study. You are invited to attend the monthly meetings, which are held from 4-7 p.m. at the Broomfield City Building, One Descombes Drive, Broomfield, CO. Three public meetings are scheduled to receive input from the community throughout all phases of the technical review. In addition, with some up-front planning, Panel members can provide briefings to community groups or interested parties. Please contact Carla Sanda at 303-277-0753 for information regarding public meetings, project updates, or speakers for your group.



PEER REVIEW TEAM MOBILIZED

To enhance the quality and credibility of this effort, the Panel has formed a Peer Review Team comprised of five nationally recognized experts with backgrounds related to this effort. Team members are tasked with reviewing and commenting on each draft final report produced for this project. Comments are then forwarded to *Risk Assessment Corporation*, who reviews and provides feedback on the peer review input. Members of the Panel then look at the Peer Review input coupled with the feedback from *RAC* to assure that Panel members concur with comment resolution.

We're on the Web:
www.rfcab.org/SALOP.html

What Is the RSALOP?

Formed in 1998, the Radionuclide Soil Action Levels Oversight Panel (RSALOP):

- Is a Citizen Oversight Group comprised of a cross-section of thirteen community representatives
- Is funded by the Department of Energy to review calculations used in setting the radionuclide soil action levels for Rocky Flats
- Seeks to assure ongoing community understanding
- Holds monthly public meetings to review the study's progress and to make recommendations
- Invites community input

RSALOP

Radionuclide Soil Action Levels Oversight Panel

What is a

"Radionuclide Soil Action Level"?

One of the primary concerns of site officials, regulators, and residents of surrounding communities is determining the amount of radionuclides that may legally remain in the soil at Rocky Flats following site remediation. These levels are known as ***"radionuclide soil action levels"*** (***RSALs***) because remediation is triggered if radiation levels in the soil exceed the established level.



Radionuclide Soil Action Levels Oversight Panel

Why Be Concerned About Plutonium?

Plutonium, the material of principal concern at Rocky Flats:

- Has a half-life of 24,000 years (remains radioactive for a quarter of a million years)
- Has been released into the environment around Rocky Flats in particle form
- Emits alpha radiation which cannot penetrate skin but which can cause harm if taken into the body
- Can be inhaled, ingested, or admitted into the body through a wound
- Is subject to movement with water or resuspension in the air if present in the soil

ANL-00

Radionuclide Soil Action Levels Oversight Panel

What's the Issue?

- Interim levels for radionuclides in soils -- or "radionuclide soil action levels" (RSALs) -- for Rocky Flats were established in 1996.
- The Rocky Flats RSALs appeared to be considerably higher than those set for sites elsewhere in the world.
- This prompted concerned citizens to ask:
 - How and why were the current Rocky Flats RSALs established?
 - Should interim levels adopted for Rocky Flats be revised?

In response to these concerns, the U.S. Department of Energy agreed to the creation of the RSALOP.



Radionuclide Soil Action Levels Oversight Panel

What's Being Done?

- The Radionuclide Soil Action Levels Oversight Panel was convened in January 1998.
- The Panel contracted with *Risk Assessment Corporation (RAC)* to review and assess the process used to determine interim radionuclide soil action levels.
- The Panel organized a peer review team to review draft reports provided by *RAC*.
- All study results and recommendations, including public comments, will be provided to the Department of Energy and its regulators for use in determining radionuclide soil action levels for the Rocky Flats site.

RAC

Radionuclide Soil Action Levels Oversight Panel

Project Overview

- *Risk Assessment Corporation* began work in October 1998 -
 - with completion scheduled for November 1999.
- Study consists of five primary tasks:
 - Assessing radionuclide soil action levels established for other sites
 - Analyzing the computer modeling program used to set interim levels and assessing other relevant computer programs
 - Analyzing inputs and assumptions for the soil action levels
 - Making independent calculations for the soil action levels
 - Recommending an appropriate soil sampling program



52 ***You're Invited . . .***

The Oversight Panel meets regularly to represent you and your community in this important effort. Your input and participation is important to the process. You can:

- Participate in monthly work sessions: 4-7 p.m. - second Thursday of each month through November 1999 at the Broomfield City Building, One Descombes Drive, Broomfield, CO
- Attend public meetings
- Share your comments and/or concerns with panel members



Radionuclide Soil Action Levels Oversight Panel

HOT SPOTS AS A FUNCTION OF AREA

September 9, 1999

Discussion and Basis of Definition

Soil action level development is based upon an assumption of averaging area. The human receptor is assumed to randomly be involved in activities for a specified time over a given area. Although a hot spot may be present, the receptor would not spend their entire exposure time at this one hot spot location. Instead the receptor is assumed to see an average of some specified area. The smallest averaging area typically considered would be that for a residential lot. The hot spot area definition is then concerned with the implications of this averaging area (i.e., residential lot) having a hot spot that may exceed the soil action levels.

Three considerations of hot spot areas and averaging were considered in the development of the definition of allowable hot spot areas. First the discussion provided by EPA for Human Health Risk Assessments (EPA 1989) which states that:

In some cases, contamination may be unevenly distributed across a site, resulting in hot spots (areas of high contamination relative to other areas of the site). If a hot spot is located near an area which, because of site or population characteristics, is visited or used more frequently, exposure to the hot spot should be assessed separately. The area over which the activity is expected to occur should be considered when averaging the monitoring data for a hot spot. For example, averaging soil data over an area the size of a residential backyard (e.g., an eighth of an acre) may be most appropriate for evaluating residential soil pathways.

The EPA recommendation would result in averaging hot spot data over an area of approximately 500 m^2 (5445 ft^2) based on the assumption of a typical backyard. The implication being that the average soil concentration in a hot spot with an area of 500 m^2 would need to meet the soil action levels, and if exceeded remediation would be required.

Secondly, the DOE manual for implementing residual radioactive guidelines (Gilbert et al., 1989) specifies an averaging area of 100 m^2 . Therefore, hot spots that are 100 m^2 in area are not allowed to exceed the soil action levels. If the soil action levels are exceeded then remediation would be required. Hot spots with areas less than 100 m^2 and greater than 25 m^2 would be area averaged with the radionuclide concentrations in the remaining areas of the 100 m^2 area to determine if the soil action levels have been attained. If the soil action levels are exceeded then remediation is required. Hot spots less than 25 m^2 are compared to a modified soil action level (Area factor approach $[(100/\text{Area})^{1/2} \times \text{RSAL}]$) first and if exceeded the hot spot requires remediation. If the hot spot average concentration is less than the modified soil action level, then the hot spot average concentration is area weighted along with the remaining soil concentrations in the 100 m^2 area to determine if the soil action levels are attained. Remediation is required if the soil action levels are exceeded.

Finally, international guidance requires sampling strategies that will detect an area of contamination equivalent to a small garden for hot spot identification (which may be $<50 \text{ m}^2$ on a modern housing development) (Petts and Smith, 1997). The Dutch soil quality criteria requires investigators to obtain enough well-located samples to typify an area $7 \text{ m} \times 7 \text{ m}$ (49 m^2) (Ministry of Housing 1994). The reference does not provide an indication of what levels within these areas would be acceptable, only that they should be

adequately sampled. It should be noted that for radionuclides, in situ gamma spectroscopy could be used in place of soil samples to attain this coverage.

These references indicate that there is a basis for establishing a maximum hot spot area that would require remediation if the average concentration of the hot spot exceeded the soil action levels. RAC recommends that hot spots of 100 m² or greater that have average soil concentrations that exceed the soil action levels be remediated. The hot spot area of 100 m² would be equivalent to a backyard that is approximately 33 ft by 33 ft. Hot spots with areas less than 100 m² could be evaluated by this same method, such that the area weighted concentration of the hot spot and the remaining area weighted concentration in the 100 m² area must be less than the soil action level. However, some limit on the hot spot concentration must be specified since very small hot spots would then be allowed to have very high concentrations if the remaining soil concentrations in the 100 m² area were far below the soil action levels.

Proposed Definition Addressing Hot Spot Area

Hot spots with areas equal to or greater than 100 m² must be remediated if the 95% upper confidence limit of the arithmetic mean soil concentrations, calculated from sample data taken in the hot spot, exceeds the soil action levels. The arithmetic mean is calculated by simple averaging of the soil concentrations in the hot spot, since the hot spot encompasses the entire averaging area of 100 m².

Remediation is required for hot spots with areas less than 100 m² when the area weighted arithmetic mean soil concentrations at the 95% upper confidence interval for the hot spot, when summed with the area weighted mean (95% CI) of the soil concentration in the remaining 100 m² area (or as an alternative, the averaging area for the residential scenario), exceeds the soil action levels. The area weighted arithmetic means are used for this case (i.e., hot spot area < 100 m²), since the hot spot area does not encompass the entire averaging area of 100 m².

Example for hot spot area < 100 m²:

Hot spot data indicate a 95% upper confidence interval of the arithmetic mean of 175 pCi/g over an area of 20 m². The 95% upper confidence interval of the arithmetic mean for the remaining 80 m² area was determined to be 75 pCi/g. Assume that the soil action level for ²⁴¹Pu was determined to be 100 pCi/g and is the only radionuclide present for simplification. The area weighted sum of the 95% CI means for an averaging area of 100 m² was then calculated as follows:

$$175 \text{ pCi/g} \cdot \left(\frac{20 \text{ m}^2}{100 \text{ m}^2} \right) + 75 \text{ pCi/g} \cdot \left(\frac{80 \text{ m}^2}{100 \text{ m}^2} \right) = 95 \text{ pCi/g}$$

The area weighted sum of the means (upper 95% CI) is less than the soil action level of 100 pCi/g for the 100 m² area so the hot spot does not require remediation.

Note

Using these definitions, it is still recommended that the RSALOP consider placing a limit (e.g. multiple of the soil action level) on hot spot concentrations that cannot be exceeded. The averaging method for hot spots used in the definition can result in allowable hot spot concentrations that may seem unacceptable from a concentration standpoint. For example, if the mean concentration throughout the averaging area is very low, say 10 pCi/g and the soil action level is 100 pCi/g, then a 10 m² hot spot could have a mean concentration, for the 100 m² averaging area, determined as follows:

$$10 \text{ pCi/g} \left(\frac{90 \text{ m}^2}{100 \text{ m}^2} \right) + X \text{ pCi/g} \left(\frac{10 \text{ m}^2}{100 \text{ m}^2} \right) = 100 \text{ pCi/g}$$

Solving for X,

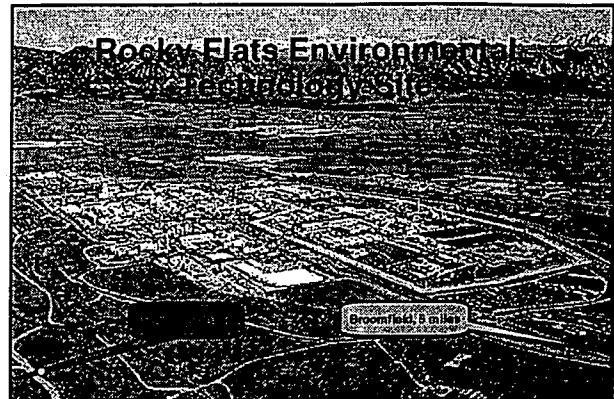
$$X \text{ pCi/g} = \left(\frac{100 \text{ pCi/g} - \left[10 \text{ pCi/g} \cdot \left(\frac{90 \text{ m}^2}{100 \text{ m}^2} \right) \right]}{\left(\frac{10 \text{ m}^2}{100 \text{ m}^2} \right)} \right) = 910 \text{ pCi/g}$$

As can be seen, when the overall soil concentrations are low, a hot spot would be allowed due to averaging that is over nine times the soil action levels. Therefore, as a secondary safety factor, the RSALOP should develop hot spot factors to ensure that hot spot concentrations cannot exceed a level for which the RSALOP considers safe regardless of the averaging process. For example, even though the hot spot example provided would be allowed an average concentration of 910 pCi/g, using DOE's guidance (Gilbert et al., 1989) a hot spot of 10 m² would have a limit of two times the soil action level or in this example 200 pCi/g, regardless of averaging. Therefore, the hot spot in this example would require remediation based on the DOE hot spot factor of two times the soil action level, even though the averaging process indicates that the average soil concentration is acceptable.

**"A REVIEW OF THE RADIONUCLIDE
SOIL ACTION LEVELS AT
THE ROCKY FLATS ENVIRONMENTAL
TECHNOLOGY SITE"**

John E. Till

Risk Assessment Corporation



**BACKGROUND INFORMATION
RELATED TO THE STUDY**

- ④ Public study
- ④ Independence
- ④ Approach to the study
- ④ Tasks and schedule



PROJECT TASKS

- ④ Task 1 : Cleanup levels at other sites (completed)
- ④ Task 2: Review computer models to calculate soil action levels (completed)
- ④ Task 3: Inputs and assumptions (draft report submitted)
- ④ Task 4: Methodology for determining soil action levels (presented to the panel)



PROJECT TASKS (Continued)

- ④ Task 5: Independent calculation of RSALs (draft report in October)
- ④ Task 6: Soil Sampling Protocol (draft report submitted)
- ④ Task 7: Interaction with Actinide Migration Panel (ongoing)
- ④ Task 8: Public Interaction (ongoing)



PRIMARY STUDY OBJECTIVE

"To estimate activity levels of man-made radionuclides (e.g. Pu, Am) in soil due to operations at the Rocky Flats Environmental Technology Site such that subsequent human exposure during future use of the site does not result in levels of radiation dose and risk that exceed specified limits."

"These activity levels are called Radionuclide Soil Action Levels or RSALs"



NORMALIZED SOIL ACTION LEVELS

Location ratio	Soil action level to dose [(pCi/g)/mrem]
Rocky Flats	17
Hanford	2.3
Nevada Test Site	4.1
Johnston Atoll	0.85
Maralinga	0.56
Palomares	12.3

RAC

TASK 2: REVIEW COMPUTER MODELS THAT CALCULATE SOIL ACTION LEVELS

- ④ Computer codes evaluated were
- MEPAS (Pacific Northwest Laboratory)
 - MMSOILS (EPA)
 - D&D (NRC)
 - GENII (Pacific Northwest Laboratory)
 - RESRAD (Argonne National Laboratory)
- ④ Our recommendation was to use the RESRAD code

RAC

TASK 3: INPUTS AND ASSUMPTIONS

- ④ The RESRAD code uses approximately 100 different input parameters in the calculation of RSALs.
- ④ In order to determine which parameters are most important, we performed a "sensitivity analysis" on the different parameters.

RAC

TASK 3: INPUTS AND ASSUMPTIONS

- ④ We found these parameters to be most sensitive:
- Mean annual wind speed
 - Area of the contaminated zone
 - Distribution coefficients
 - Mass loading

RAC

TASK 3: INPUTS AND ASSUMPTIONS

WE ARE TAKING A NEW,
STOCHASTIC APPROACH, TO CALCULATING THE RSALS

- ④ Some parameters are represented by probability distributions rather than a single value
- ④ Results will be expressed in terms of probability statements about the computational endpoint

RAC

TASK 3: INPUTS AND ASSUMPTIONS WHAT IS AN EXPOSURE SCENARIO?

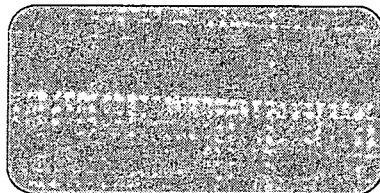
- ④ An exposure scenario is a profile of a hypothetical individual living or using the Rocky Flats site with particular characteristics and a defined lifestyle
- ④ The scenario may refer to a succession of hypothetical individuals over time (for example, 1000 years)
- ④ A goal for designing the scenarios in this study is that if the hypothetical individual living on or using the site is protected, then it is reasonable to assume that others will be protected

RAC

TASK 6: SOIL SAMPLING PROTOCOL

HOT SPOTS

Area of interest
having
approximately
uniform
concentration

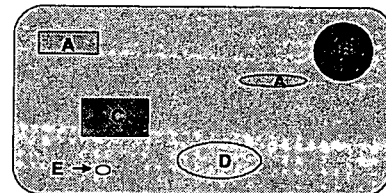


RAC

TASK 6: SOIL SAMPLING PROTOCOL

HOT SPOTS

Within the
area of
interest there
are smaller
areas of
elevated
concentration

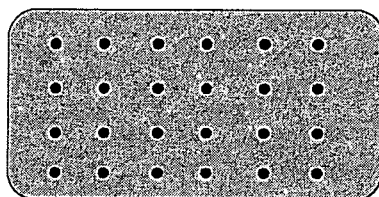


RAC

TASK 6: SOIL SAMPLING PROTOCOL

HOT SPOTS

The sample
protocol calls
for samples to
be taken at
these locations

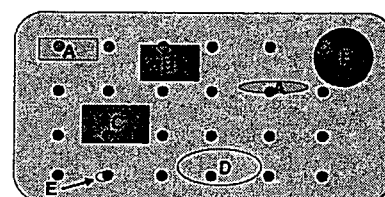


RAC

TASK 6: SOIL SAMPLING PROTOCOL

HOT SPOTS

Assume the
sample results
tell us each of
the samples is
less than the
RSAL except for
location "E" and
this sample is 3
times greater
than the RSAL.



RAC

TASK 6: SOIL SAMPLING PROTOCOL

HOT SPOTS

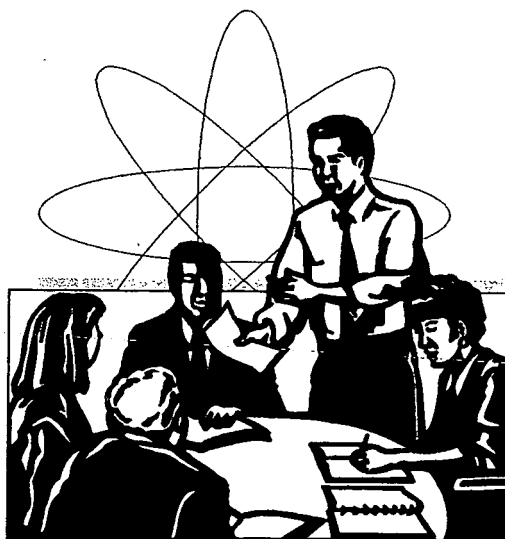
- ④ It is reasonable to assume that a hot spot(s) can exist within a defined area and the RSAL for the area will still be met.
- ④ If a hot spot is discovered, its extent must be determined to see whether further sampling or remedial action is required.
- ④ RAC and the panel are considering recommending a limit above which a hot spot cannot be exceeded without action to reduce the level of contamination.

RAC

CONCLUSIONS

- ④ Public study — oversight panel's role is critical and unique.
- ④ RAC's approach is different from that taken previously at Rocky Flats and at other sites.
- ④ Key tasks remain to be done but we are working toward completion of the study by the end of the year.

RAC



REMINDER

Radionuclide Soil Action Level Oversight Panel

Public Meeting

**Wednesday, Sept. 8, 1999—7:00—9:00 p.m.
Broomfield City Bldg—Council Chambers**



Panel Meeting

**Thursday, Sep. 9, 1999
4:00—7:00 p.m.**

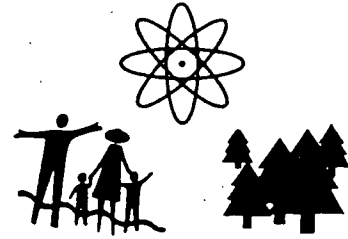
**Broomfield City Bldg—Zang's Spur Conf Rm
Technical Session: 2:30—3:30**

For Additional Information, Call: Carla Sanda 303-277-0753





Radionuclide Soil Action Level Oversight Panel



August 12, 1999

Jessie M. Roberson, Manager
U. S. Department of Energy - Rocky Flats Field Office
PO Box 928
Golden, CO 80402

Dear Jessie:

On behalf of the Radionuclide Soil Action Level Oversight Panel, we would like to extend a personal invitation for you to join us at our second public meeting the evening of September 9. It will be held from 7:00 - 9:00 p.m. at the Broomfield City Center - Council Chambers. We look forward to updating the community at large on this effort and continue to invite their input as we work through the critical remaining weeks of the technical study.

We have now passed the mid-point on the technical review of the radionuclide soil action levels. *Risk Assessment Corporation (RAC)* completed the Task 2 Report - Computer Models. Based upon the extensive evaluation of available computer codes, as described in this report, and input from the Panel, *Risk Assessment Corporation* is using the RESRAD code for this technical review.

The Task 6 Draft Report: Sampling Protocols has been completed. RAC has reviewed and incorporated comments received from the Peer Review Team and the Panel. Work continues on this report, with completion expected in September 1999.

In addition, the Task 3 Draft Report: Inputs and Assumptions, was released for review at our July meeting. This report focused on the key parameters that will most influence the outcome of the soil action level calculation. Extensive details and justification are provided for those parameters. Comments from the Panel and Peer Review Team have been received and forwarded to RAC for their consideration.

The Panel also hosted a workshop on August 12 entitled *Radiation Detection & Instrumentation*. Presenters from the EPA's Las Vegas Radiation & Indoor Environments National Laboratory, Canberra Industries, RMRS, and Kaiser-Hill provided information to the Panel on current methods for radiation detection. In addition, the workshop was videotaped for use by Panel members who were unable to attend as well as community members who express interest in the subject.

Panel members appreciate your support of their work on this project and hope that you can join us at the public meeting. We look forward to seeing you then!

Sincerely,

Original Signed By

Hank Stovall, Co-Chair
Radionuclide Soil Action Level Oversight Panel
(303) 466-5986

Original Signed By

Mary Harlow, Co-Chair
Radionuclide Soil Action Level Oversight Panel
(303) 430-2400 - Ext. 2174

cc:
RSALOP Members

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RSALOP

Radionuclide Soil Action Levels Oversight Panel



PUBLIC MEETING

"Planning for Tomorrow....."

Radionuclide Soil Action Levels at Rocky Flats"

Where: Broomfield City Center - Council Chambers
One Descombes Dr.
Broomfield, CO 80030

When: Wednesday, September 8, 1999
7:00 - 9:00 PM

- What's been learned to date and how does that affect me?
- What factors determine a radionuclide soil action level?
- How might future land use affect a radionuclide soil action level?
- How can we work together to protect today's and tomorrow's communities?

A community-directed, independent study to review and assess the Recommended levels for plutonium that may legally remain in the soil at Rocky Flats is nearing its completion. Your input is needed as we work together towards a decision that could affect your future. To learn more about these questions and the on-going study, please join us for this important discussion. For further information, please contact either Carla Sanda, Advanced Integrated Management Services, Inc. (303-277-0753), or Ken Korkia, Rocky Flats Citizens Advisory Board (303-420-7855).

SENTINELS – THURSDAY, 09/02/99 - \$402.80

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Jefferson
Northglenn
Thornton
Westminster
Broomfield
Golden

BOULDER DAILY CAMERA – MONDAY, 09/06/99 - \$239.00

Carla

SEPTEMBER PUBLIC MEETING COMPLETED LOGISTICS

Display Ad – Sentinels & Daily Camera

Postcard Mailing

UPDATE Newsletter

Press Release

Invitation to Jessie Roberson

Reminder flyer to fax/mailling list

Meeting Evaluation/Sign-Up Sheet// Name Tags

Storyboard easels affixed to back

Logistics confirmed w/Broomfield

Microphone, Info Table, Water, Coffee, Cookies

March 23, 2000

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